V23990-P824-F10-PM
datasheet

Vincotech

***flow*PACK 1** — **600 V / 75 A**

Features

- Compact *flow* 1 housing
- Compact and Low Inductance Design
- Built-in NTC

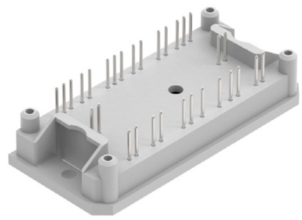
Target applications

- Motor Drive
- Power Generation
- UPS

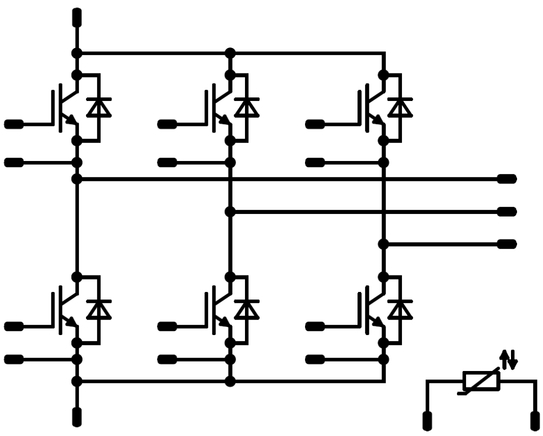
Types

- V23990-P824-F10-PM

flow 1 housing



Schematic



Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		600	V
Collector current	I_C	$T_j = T_{jmax}$ T_s = 80 °C	58	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	225	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	94	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V Vcc = 360 V T_j = 150 °C	6	µs
Maximum junction temperature	T_{jmax}		175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter Diode					
Peak repetitive reverse voltage	V_{RRM}			600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	48	A
Repetitive peak forward current	I_{FRM}			150	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	69	W
Maximum junction temperature	T_{jmax}			175	°C

Module Properties

Thermal Properties

Parameter	Symbol	Condition		Value	Unit
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{jop}			-40…(T_{jmax} - 25)	°C

Isolation Properties

Parameter	Symbol	Condition		Value	Unit
Isolation voltage	V_{isol}	DC Test Voltage*	t_p = 2 s	6000	V
		AC Voltage	t_p = 1 min	2500	V
Creepage distance				min. 12,7	mm
Clearance				12,64	mm
Comparative Tracking Index	CTI			> 200	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0012	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		75	25 150	1,05	1,54 1,79	1,85	V
Collector-emitter cut-off current	I_{CES}		0	600		25			3,8	µA
Gate-emitter leakage current	I_{GES}		20	0		25			600	nA
Internal gate resistance	r_g							4		Ω
Input capacitance	C_{ies}	f= 1 Mhz	0	25		25		4700		pF
Output capacitance	C_{oes}							300		
Reverse transfer capacitance	C_{res}							145		
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 1 W/mK (P12)						1,01		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	±15	300	75	25 150		160 162		ns
Rise time	t_r					25 150		21 26		
Turn-off delay time	$t_{d(off)}$					25 150		208 242		
Fall time	t_f					25 150		105 118		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 2,2 µC Q_{rFWD} = 6,8 µC				25 150		1,08 1,60		mWs
Turn-off energy (per pulse)	E_{off}					25 150		1,99 2,76		

Characteristic Values

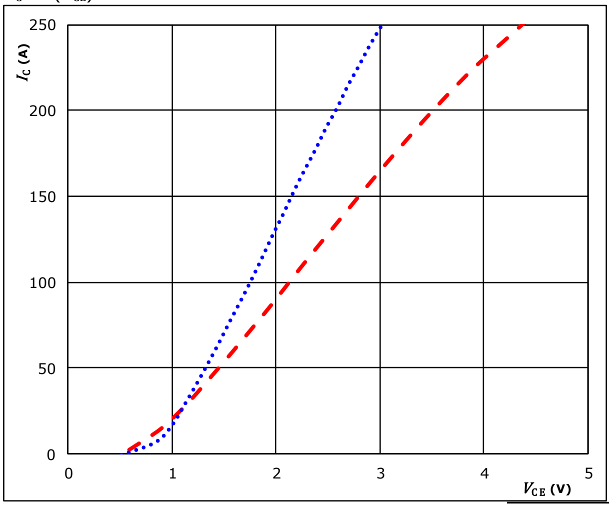
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter Diode										
Static										
Forward voltage	V_F				75	25 150	1,2	1,79 1,75	1,9	V
Reverse leakage current	I_R			600		25			27	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 1 W/mK (P12)						1,38		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 4256 A/µs di/dt = 3706 A/µs	±15	300	75	25 150		58 88		A
Reverse recovery time	t_{rr}					25 150		133 169		ns
Recovered charge	Q_r					25 150		2,23 6,83		µC
Reverse recovered energy	E_{rec}					25 150		0,51 1,50		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		3338 3540		A/µs
Thermistor										
Rated resistance	R					25		4,7		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 401 Ω				100	-12,4		12,4	%
Power dissipation	P					25		210		mW
Power dissipation constant						25		3,5		mW/K
B-value	$B_{(25/50)}$					25		3590		K
B-value	$B_{(25/100)}$					25		3650		K
V_{in}cotech NTC Reference									D	

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

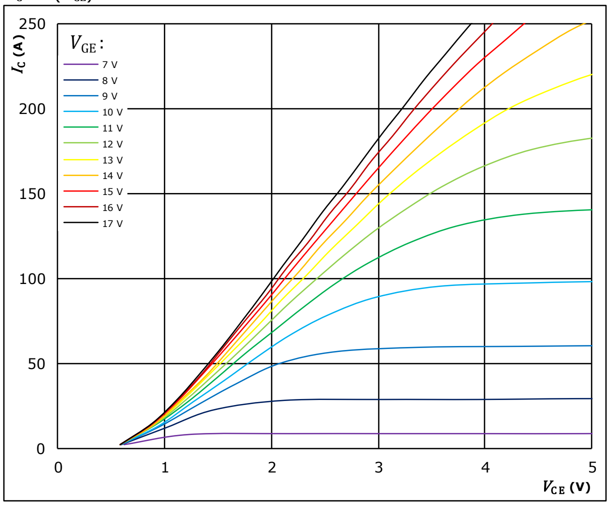


t_p =	250	μs	T_j:	25	°C	···········
V_{GE} =	15	V		150	°C	– – –

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

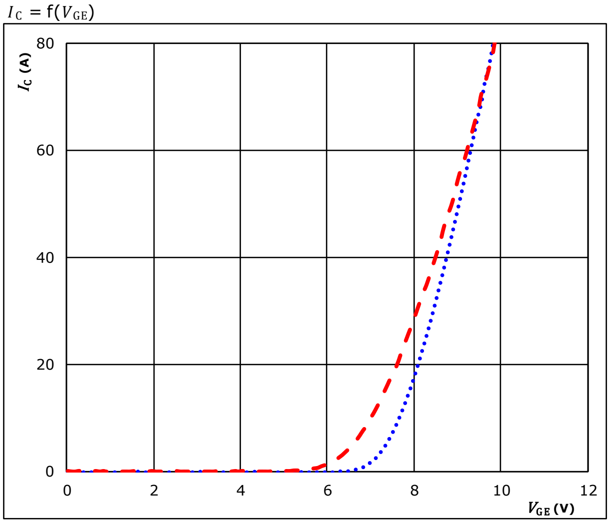


t_p = 250 μs
T_j = 150 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

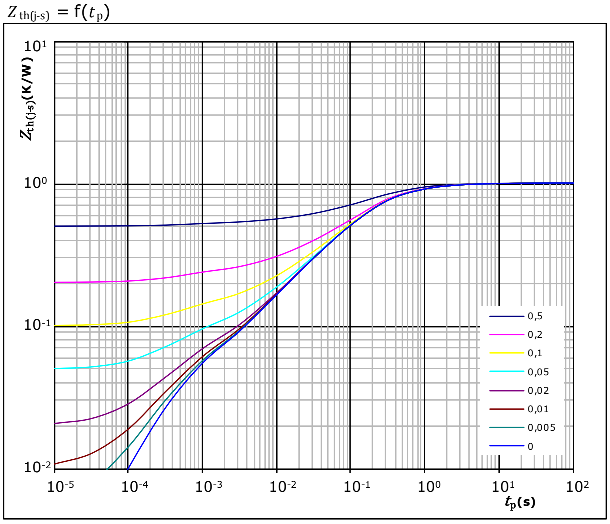


t_p =	100	μs	T_j:	25	°C	···········
V_{CE} =	10	V		150	°C	– – –

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

$Z_{th(j-s)} = f(t_p)$



D = t_p / T
$R_{th(j-s)}$ = 1,01 K/W

IGBT thermal model values

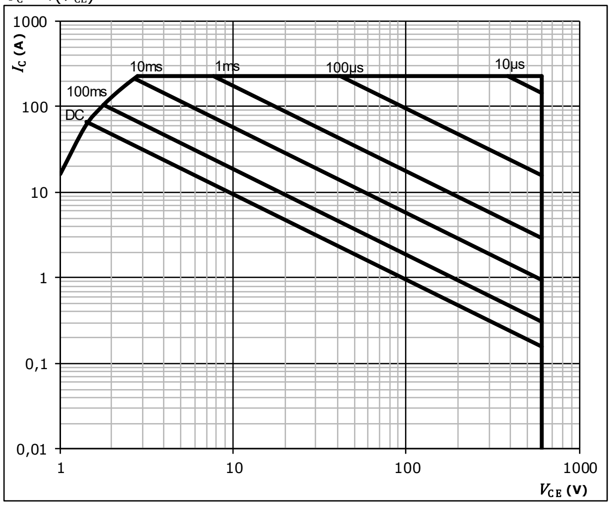
R (K/W)	τ (s)
2,59E-02	9,79E+00
1,63E-01	1,12E+00
5,38E-01	1,83E-01
1,81E-01	3,28E-02
5,68E-02	5,83E-03
4,25E-02	4,57E-04

Inverter Switch Characteristics

figure 5. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



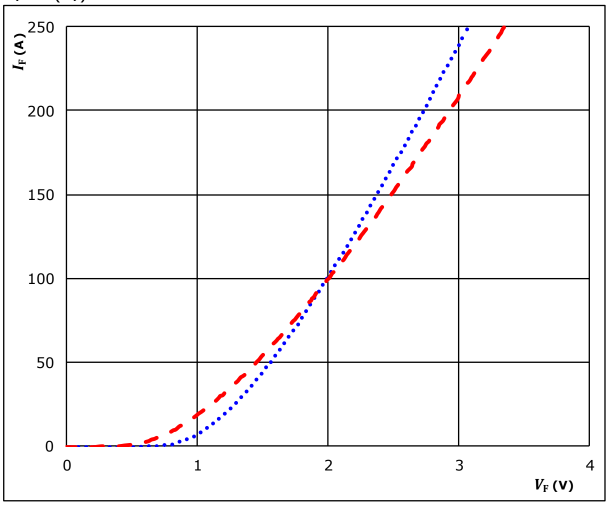
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Inverter Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$

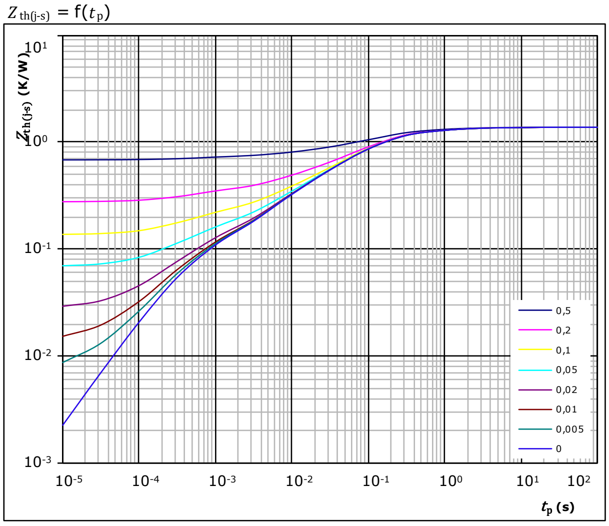


t_p =	250	µs	T_j:	25 °C	············
				150 °C	– – – –

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

$Z_{th(j\text{-}s)} = f(t_p)$



D = t_p / T

$R_{th(j\text{-}s)}$ = 1,38 K/W

FWD thermal model values

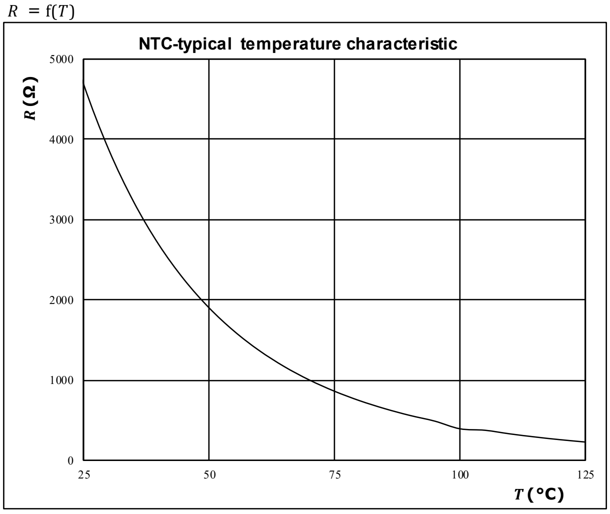
R (K/W)	τ (s)
2,87E-02	9,94E+00
1,67E-01	1,04E+00
6,44E-01	1,45E-01
3,12E-01	3,35E-02
1,48E-01	6,15E-03
8,16E-02	4,22E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic as a function of temperature

$R = f(T)$

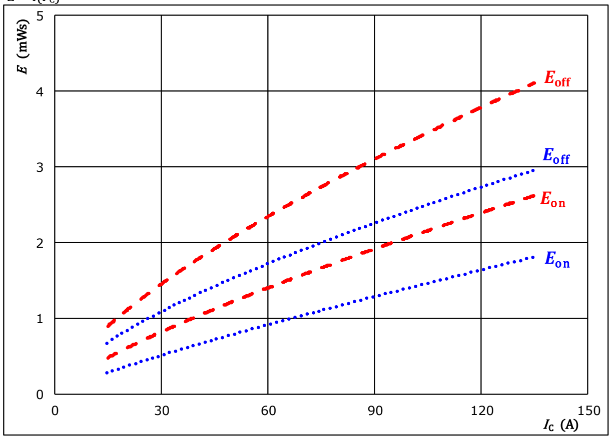


Inverter Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



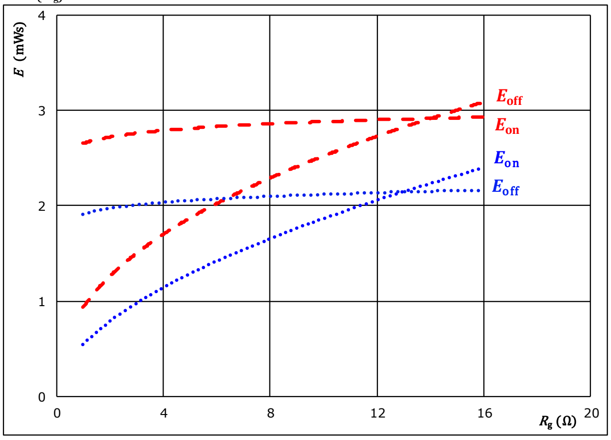
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C	············
V_{GE} =	±15	V		150 °C	– – – –
R_{gon} =	4	Ω			
R_{goff} =	4	Ω			

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



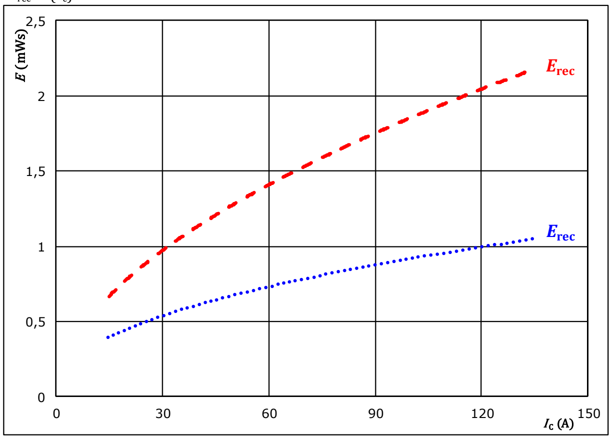
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C	············
V_{GE} =	±15	V		150 °C	– – – –
I_C =	75	A			

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_c)$



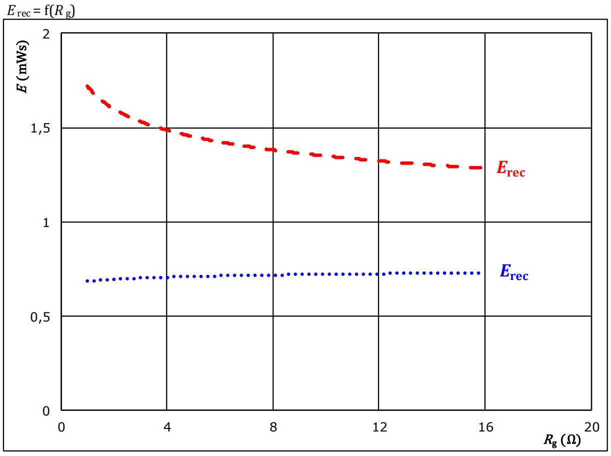
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C	············
V_{GE} =	±15	V		150 °C	– – – –
R_{gon} =	4	Ω			

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

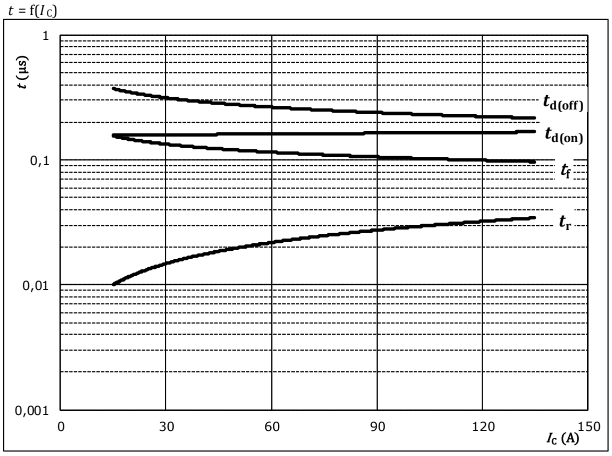
V_{CE} =	300	V	T_j:	25 °C	············
V_{GE} =	±15	V		150 °C	– – – –
I_C =	75	A			

Inverter Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



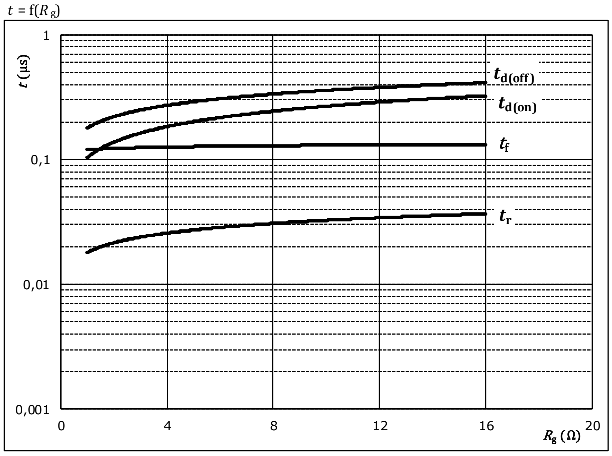
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



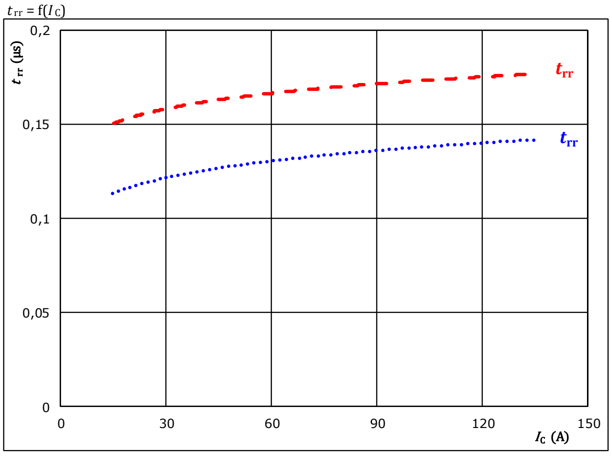
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	75	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

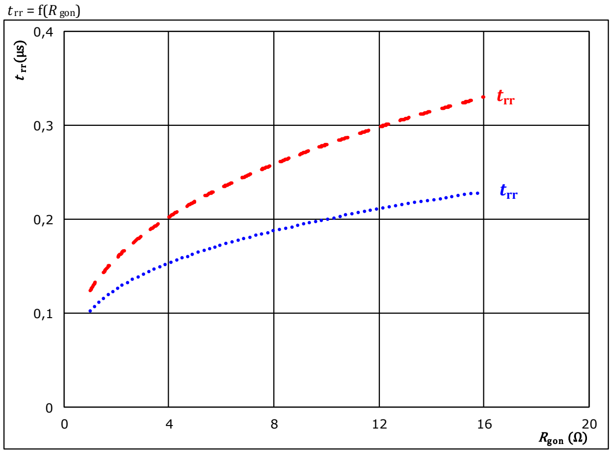


At					
V_{CE}=	300	V	T_j:	25 °C	··············
V_{GE} =	±15	V		150 °C	– – – –
R_{gon} =	4	Ω			

figure 8. **FWD**

Typical reverse recovery time as a function of IGBT turn on gate resistor

$t_{rr} = f(R_{gon})$



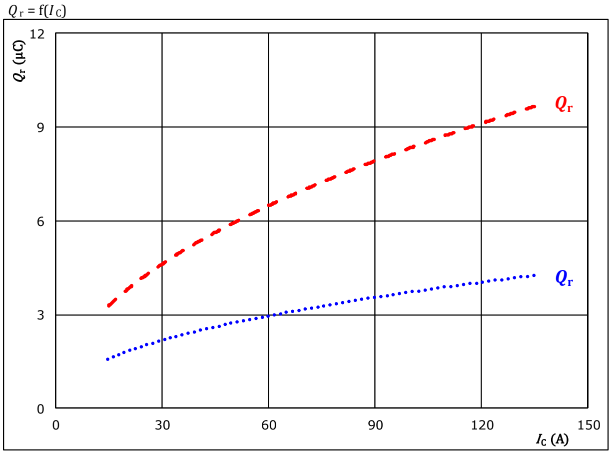
At					
V_{CE} =	300	V	T_j:	25 °C	··············
V_{GE} =	±15	V		150 °C	– – – –
I_C =	75	A			

Inverter Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

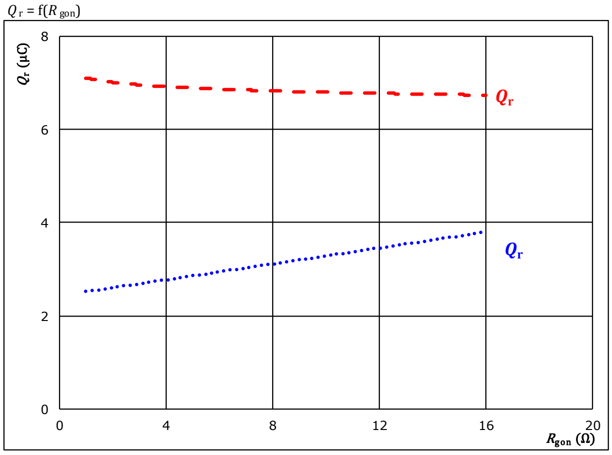


At				
V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		150 °C
R_{gon} =	4	Ω		

figure 10. **FWD**

Typical recovered charge as a function of IGBT turn on gate resistor

$Q_r = f(R_{gon})$

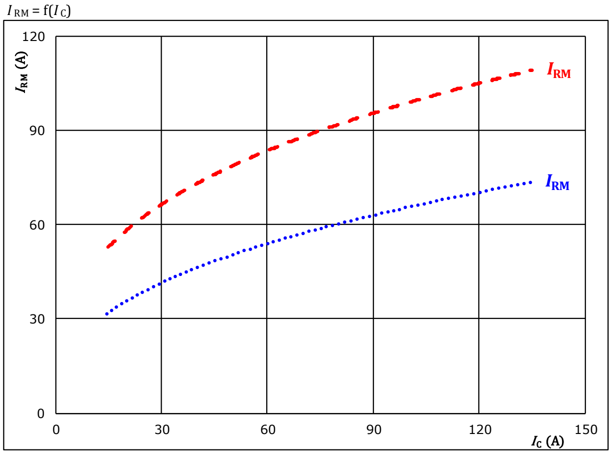


At				
V_{CE}=	300	V	T_j:	25 °C
V_{GE} =	±15	V		150 °C
I_C=	75	A		

figure 11. **FWD**

Typical peak reverse recovery current current as a function of collector current

$I_{RM} = f(I_C)$

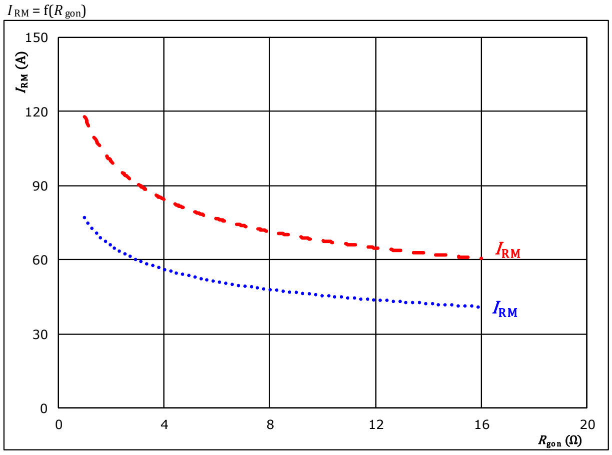


At				
V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		150 °C
R_{gon} =	4	Ω		

figure 12. **FWD**

Typical peak reverse recovery current as a function of IGBT turn on gate resistor

$I_{RM} = f(R_{gon})$



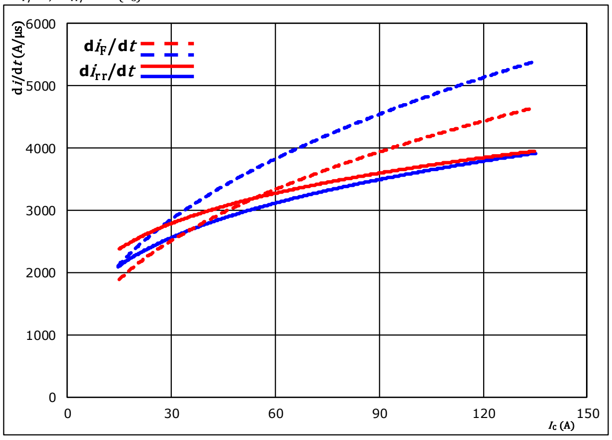
At				
V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		150 °C
I_C =	75	A		

Inverter Switching Characteristics

figure 13. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of collector current

$di_F/dt, di_{rr}/dt = f(I_C)$

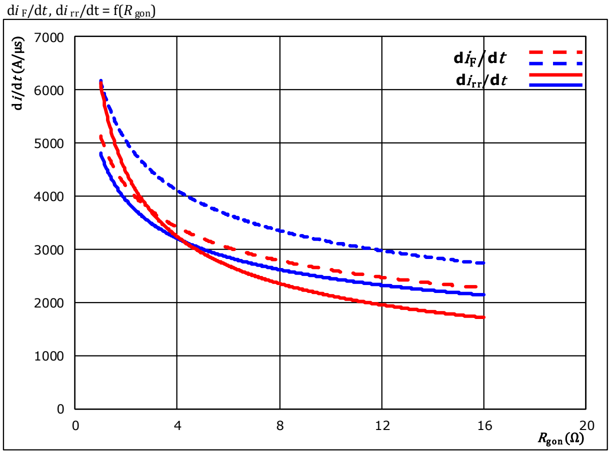


At
V_{CE} = 300 V
V_{GE} = ±15 V
R_{gon} = 4 Ω
T_j: 25 °C
150 °C

figure 14. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor

$di_F/dt, di_{rr}/dt = f(R_{gon})$

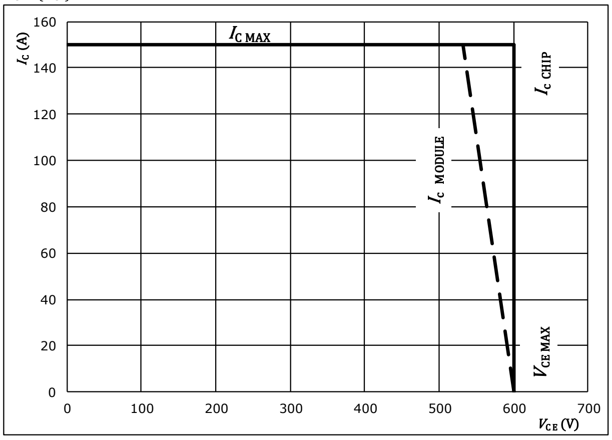


At
V_{CE} = 300 V
V_{GE} = ±15 V
I_C = 75 A
T_j: 25 °C
150 °C

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At
T_j = 125 °C
R_{gon} = 4 Ω
R_{goff} = 4 Ω

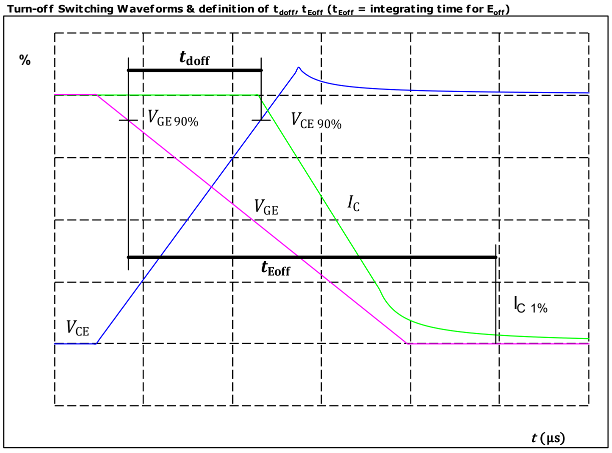
Inverter Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	4 Ω
R_{goff}	=	4 Ω

figure 1. **IGBT**

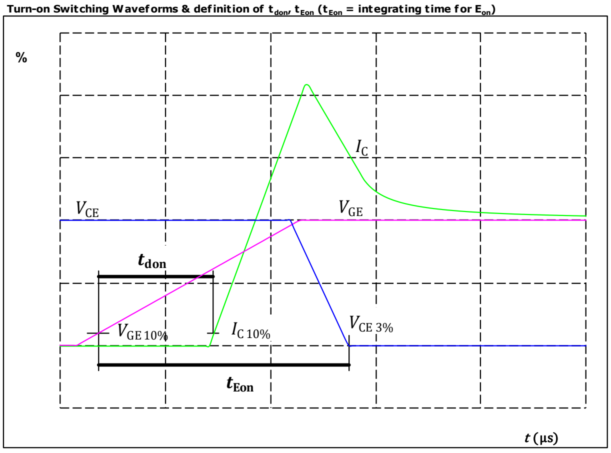
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	75	A
t_{doff} =	242	ns

figure 2. **IGBT**

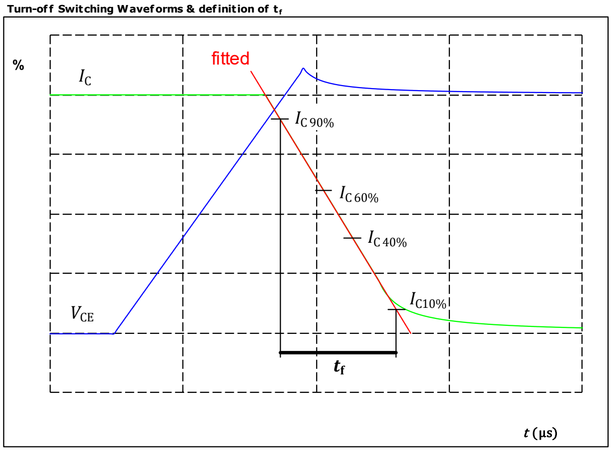
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	75	A
t_{don} =	162	ns

figure 3. **IGBT**

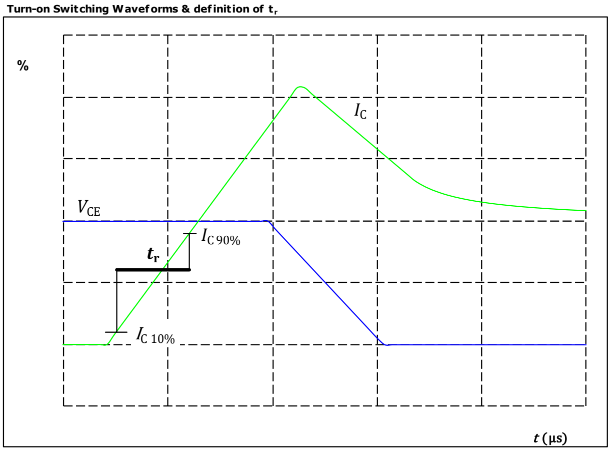
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	300	V
I_C (100%) =	75	A
t_f =	118	ns

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

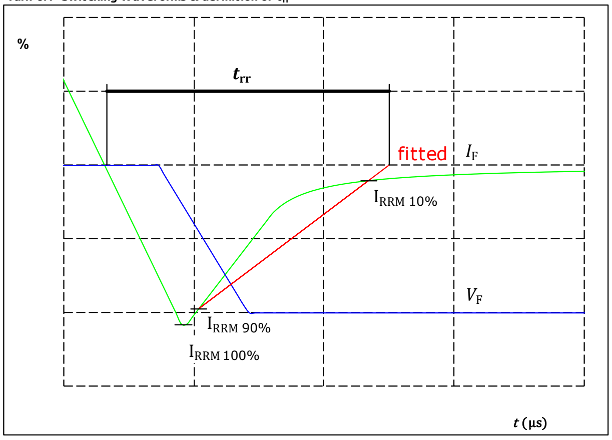


V_C (100%) =	300	V
I_C (100%) =	75	A
t_r =	26	ns

Inverter Switching Characteristics

figure 5. **FWD**

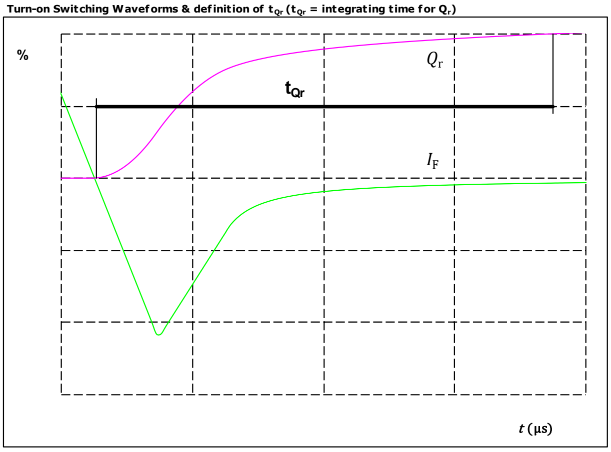
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) =	300	V
I_F (100%) =	75	A
I_{RRM} (100%) =	88	A
t_{rr} =	169	ns

figure 6. **FWD**

Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)

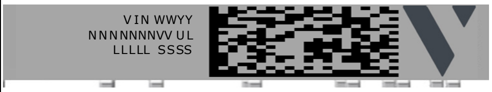


I_F (100%) =	75	A
Q_r (100%) =	6,83	µC

Vincotech

Ordering Code & Marking

Version	Ordering Code
without thermal paste	V23990-P824-F10-PM

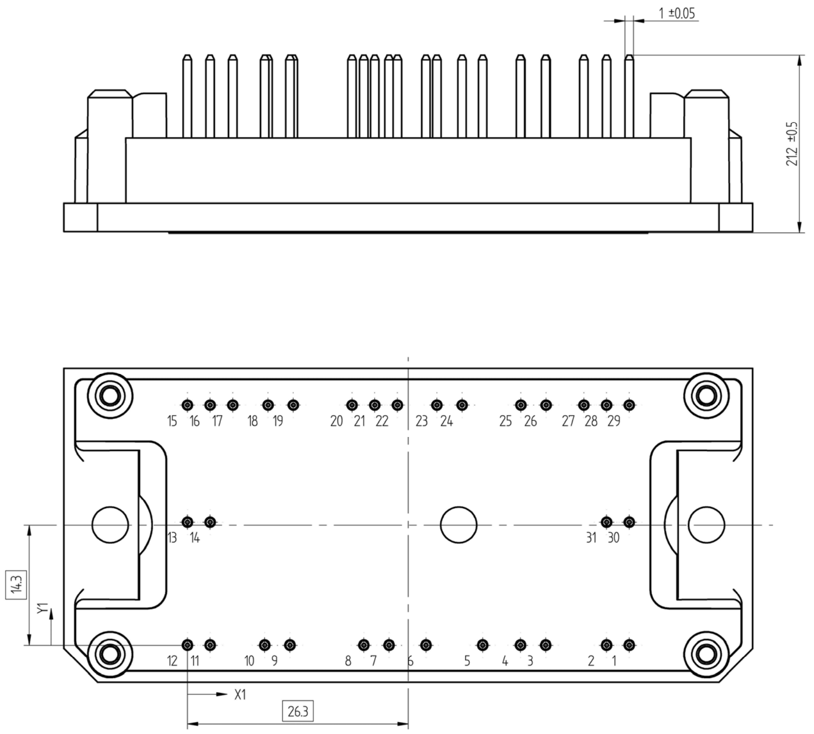


	VIN	Date code	Name&Ver	UL	Lot	Serial
Text	VIN	WWYY	NNNNNNNVV	UL	LLLLL	SSSS
	Type&Ver	**Lot number**	**Serial**	**Date code**		
Datamatrix	TTTTTTTVV	LLLLL	SSSS	WWYY		

Outline

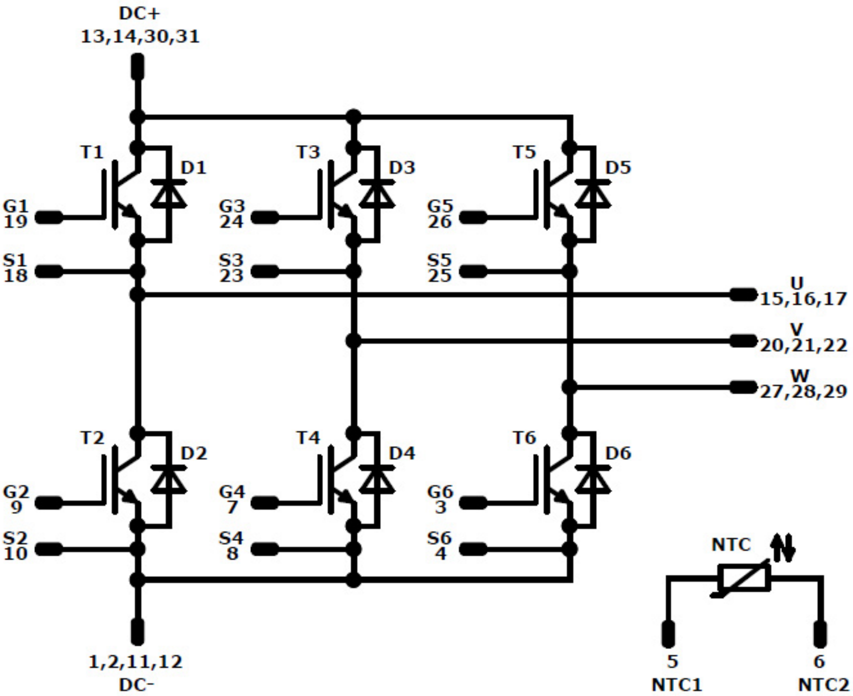
Pin table

Pin	X	Y	Functions
1	52,6	0	DC-
2	49,9	0	DC-
3	42,65	0	G6
4	39,65	0	S6
5	35,15	0	NTC1
6	28,4	0	NTC2
7	24	0	G4
8	21	0	S4
9	12,2	0	G2
10	9,2	0	S2
11	2,7	0	DC-
12	0	0	DC-
13	0	14,65	DC+
14	2,7	14,65	DC+
15	0	28,6	U
16	2,7	28,6	U
17	5,4	28,6	U
18	9,6	28,6	S1
19	12,6	28,6	G1
20	19,6	28,6	V
21	22,3	28,6	V
22	25	28,6	V
23	29,7	28,6	S3
24	32,7	28,6	G3
25	39,7	28,6	S5
26	42,7	28,6	G5
27	47,2	28,6	W
28	49,9	28,6	W
29	52,6	28,6	W
30	52,6	14,65	DC+
31	49,9	14,65	DC+



Tolerance of pinpositions: ±0,5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	600 V	75 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	600 V	75 A	Inverter Diode	
NTC	NTC			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 100	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 1 packages see vincotech.com website.

Package data
Package data for *flow* 1 packages see vincotech.com website.

UL recognition and file number
This device is certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
V23990-P824-F10-D5-14	12 Jul. 2018		